

## **1 16. FISH AND WILDLIFE PASSAGE RESTORATION – [Low]**

Refer to Fish Passage at Road Culverts and Fishway Design manuals [from WDFW] and Proceedings, International Conference on Environment and Transportation (ICOET) conference

### **1.1 Introduction**

#### **1.1.1 Description of Technique**

Passage of migratory species at barriers  
refer to Fish Passage at Road Culverts and Fishway Design manuals [from WDFW].  
Refer to state law – Ken can provide information in form of WDFW passage policy

#### **1.1.2 Physical and Biological Effects**

Biological effects are providing access to habitat, particularly for migratory fishes – table of migratory fish in Washington

##### Anadromous

Steelhead  
Coho, chinook, pink, chum, sockeye salmon  
Cutthroat trout  
Pacific lamprey

##### Non-anadromous

Juvenile coho, chinook, and steelhead  
Kokanee  
Rainbow and Cutthroat trout  
Brown and brook trout  
Bull trout / Dolly Varden  
Mud minnow  
Stickleback  
Sculpin  
Pygmy and Mountain whitefish  
Minnows  
Pacific Lamprey  
Suckers  
Nooksack dace  
Sturgeon (adult and juvenile)

Reasons for movement

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Fry - dispersal, spread risk, reduce competition

Parr - optimal rearing (e.g. reduce competition, good quality and quantity of water, good habitat, food, fewer predators) – discuss lateral movement out of rivers into tributaries and side channels

Smolt - movement to ocean for enhanced growth

Adult – distribution, optimal rearing, spawning

Many species of amphibians, reptiles and mammals also use stream corridors for migration and as daily movement corridors. Culverted streams under roads pose substantial barriers to such passage and have been the subject of numerous experimental and more developed designs to accommodate terrestrial wildlife as well as fish passage along culverted streams.

Physical effects may include change in sediment character (short term), or hydraulic and habitat character of reach by altering slope and/or channel shape, need for instream maintenance, construction activities

NOTE – THIS TECHNIQUE ENDS HERE THE REMAINING PARTS ARE INCLUDED IN OTHER FISH PASSAGE GUIDANCE.

### *1.1.3 Application of Technique*

Alluvial vs. non-alluvial

## **1.2 Scale**

Small streams vs. large rivers

## **1.3 Risk and Uncertainty**

Urban vs. non-urban: urban may be lots of culverts, etc.

Uncertainty in hydraulic design

Passage varies and is affected by varying water depth/velocity

## **1.4 Data Collection and Assessment**

- Biological assessment of habitat needs in subject reach.
- Hydrology and hydraulics
- Sediment transport
- Fluvial Geomorphic Assessment and History
- Watershed Processes and History

## **1.5 Methods and Design**

Include, by reference, techniques for facilitating fish passage at culverts, bridges, other structures (e.g., weirs), and at natural barriers like waterfalls. Refer to Fish Passage at Road Culverts and Fishway Design manuals [from WDFW.

Discuss velocity vs. physical barriers

Discuss consideration of passage at varying discharges

## **1.6 Project Implementation**

### **1.6.1 Permitting**

- Project Volumes (Cut and Fill), Construction Design and Methods
- Construct Drawings, Plan Views and Maps
- Sediment Control Plan
- Heavy Equipment Fueling Areas and Spill Plan
- Access Area Rehabilitation Plans

### **1.6.2 Construction**

- Fish Species Work Window and Construction Timing
- Equipment Access Areas

### **1.6.3 Cost Estimation**

- Picnic Point creek project description and cost
- Culvert costs

### **1.6.4 Monitoring and Tracking**

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- Section and Profile Data
- Bed Substrate Data
- Photo Points
- Reach Based Fish Snorkeling

### ***1.6.5 Contracting Considerations***

Discuss aspects that may not be typical for contractors, or where specialty contractors may need to be utilized.

## ***1.7 Operations and Maintenance***

Relative to monitoring and objectives .

Maintenance of culverts – cleaning and clearing

Removal of debris jams to promote passage?

## ***1.8 Examples***

Picnic Point creek, WA

## ***1.9 References***

References cited in this technique so it is a stand-alone pullout.

## ***1.10 Photo and Drawing File Names***

List filenames and file locations of any photos and drawing files associated with this technique